

## **MICHAEL Q. WANG, PhD**

Vehicle and Fuel Systems Analyst  
Manager of Systems Assessment Section  
Center for Transportation Research (CTR)  
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Argonne National Laboratory (ANL)

### **SUMMARY**

Dr. Wang has been working in the Center for Transportation Research of Argonne National Laboratory since 1991. He is the manager of the Systems Assessment Section in the center to evaluate energy and emission effects of advanced vehicle technologies and new transportation fuels. He has developed the GREET (Greenhouse gases, Regulated Emissions, and Energy use in Transportation) model. With GREET, he has conducted several major studies for U.S. Department of Energy, state of Illinois, the General Motors Corporation, and the U.S. Environmental Protection Agency. His work and the GREET model have set industry standard for well-to-wheels analysis of vehicle/fuel systems. At present, there are more than 1,700 registered GREET users worldwide. Besides technical responsibilities, Dr. Wang has been taking management responsibilities at Argonne in recent years.

Dr. Wang has been active in professional organizations and activities. He serves on the board of the not-for-profit Energy Foundation; the chair of the Subcommittee on the International Aspects of Transportation Energy and Alternative Fuels of the U.S. Transportation Research Board; an oversea Chinese expert advisor to the Beijing Municipal Government's Science and Technology Commission; a technical advisor to China Automotive Technology and Research Center; a member of a PhD student dissertation committee in University of Illinois at Chicago; and a member of the External Advisor Board of Institute for Environmental Science and Policy at University of Illinois at Chicago. He has served as critical reviewer of several major studies on advanced vehicle technologies and new transportation fuels conducted by or for governmental agencies, automotive companies, and energy companies.

Dr. Wang has produced 118 publications (49 journal articles and book chapters, 22 conference papers, 23 formal reports, and 29 informal reports and technical memorandums) and made additional 46 technical presentations in professional conferences and to organizations on request.

### **EDUCATIONAL BACKGROUND**

Ph.D. 1992, Ecology, University of California at Davis, CA.

Thesis: the Use of a Marketable Permit System for Light-Duty Vehicle Emission Control

M.S. 1989, Ecology, University of California at Davis, CA

B.S. 1982, Agricultural Meteorology, China Agricultural University, Beijing, China

### **PROFESSIONAL EXPERIENCE**

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| 1993-now  | Section manager and vehicle and fuel systems analyst, Center for Transportation Research, Energy Systems Division, Argonne National Laboratory |
| 1992-1993 | Assistant research engineer, Institute of Transportation Studies, University of California at Davis  |

1991-1993	Special-term scientist appointee, Center for Transportation Research, Energy Systems Division, Argonne National Laboratory
1991-1992	Postdoctoral researcher, Center for Transportation Analysis, Oak Ridge National Laboratory
1989-1991	Postgraduate researcher, Department of Civil Engineering and Division of Environmental Studies, University of California at Davis
1982-1985	Lecturer, Agro-Meteorology Department, China Agricultural University, Beijing, China

## **PROFESSIONAL ASSOCIATION MEMBERSHIPS**

02/2002 to now	Chair, Subcommittee on International Aspects of Transportation Energy and Alternative Fuels, Transportation Research Board, National Research Council, USA
03/1997 to now	Member, Energy Conservation Committee, Transportation Research Board, National Research Council, USA
01/1998 to now	Member, North American Chinese Overseas Transportation Association
07/1990 to now	Member, Mobile Source Committee, Air and Waste Management Association
09/1993 to now	Member, Society of Automotive Engineers

## **MAJOR PROFESSIONAL ACTIVITIES**

01/2005	Organized and chaired a technical session at the 2005 Annual Meeting of Transportation Research Board, Washington, D.C., Jan. 12
06/2001 to now	A key participant of the IEA Annex XV on fuel cell systems analysis
01/2002	Organized a workshop on life-cycle analysis of advanced vehicle technologies and transportation fuels for the 2002 Annual TRB Meeting, Washington, D.C., Jan. 13 <sup>th</sup>
1998-1999	Organized technical sessions for the 1998 and 1999 annual meetings of the Air and Waste Management Association
1998-2003	Organized technical sessions for 1998, 1999, 2001, and 2003 Transportation Research Board annual meetings

## **MAJOR PROFESSIONAL ADVISORSHIPS**

10/2004-now	Technical advisor to China Automotive Technology and Research Center
08/2004-now	Critical reviewer of life-cycle analysis of gas-to-liquids, SasolChevron, London, the U.K.
02/2004-now	Member of the International Team, Sustainable Transportation Task Force, China Council for International Cooperation on Environment and Development
09/2003-now	Member of the External Advisory Board, Institute for Environmental Science and Policy, University of Illinois at Chicago
04/2001-now	Board director, the Energy Foundation, San Francisco, CA

06/2002-now	Member of a Ph.D. student dissertation committee, University of Illinois at Chicago
12/2000-now	Overseas Chinese Expert Advisor, Science and Technology Commission of Beijing Municipal Government
12/2001-now	Guidance to and review of the China Sustainable Energy Program of the Energy Foundation, San Francisco, CA
01/2000-01/2003	Board director, North American Chinese Oversea Transportation Association
07/1999-07/2001	Member of the Technical Advisory Committee for the project on fuel cycle analyses of vehicle/fuel systems, California Air Resources Board, Sacramento, CA
05/2000-05/2003	Member of the Technical Review Committee for the project on life-cycle assessment of corn stover to ethanol production, National Renewable Energy Laboratory, Golden, CO
01/1998-10/1998	Member of the Peer Review Committee for the project on life cycle analysis of biomass to fuel oxygenates, California Air Resources Board, California Energy Commission, California Department of Forestry and Fire Protection, and California Department of Food and Agriculture, Sacramento, CA
01/1996-10/1996	Member of the Technical Advisory Committee for the study on economics and environmental impacts of alternative-fueled vehicles, Canadian Energy Research Institute, Calgary, Alberta, Canada

## PEER-REVIEWED JOURNAL ARTICLES AND BOOK CHAPTERS

M. Wang, C. Saricks, and M. Wu, 2004, "Responses to and Comments on Ethanol from Corn: Clean Renewable Fuels for the Future, or Drain on Our Resources and Pockets?" submitted to *Journal of Environment, Development, and Sustainability*.

K. He, H. Huo, Q. Zhang, D. He, F. An, M. Wang, and M. Walsh, 2004, "Oil Consumption and CO<sub>2</sub> Emissions in China's Road Transport: Current Status, Future Trends, and Policy Implications," forthcoming in *Energy Policy*.

L. Lynd and M. Wang, 2004, "A Product Nonspecific Framework for Evaluating the Potential of Biomass-Based Products to Displace Fossil Fuels," *Journal of Industrial Ecology*, Vol.7, No.3-4: 17-32.

M. Wang, 2004, "Fuel-Cycle Analysis of Conventional and Alternative Fuel Vehicles," *Encyclopedia of Energy*, Edited by C.J. Cleveland, Vol. 2, pp.771-789, Elsevier, Inc.

M. Wang, 2004, "Emission Control Cost-effectiveness of Mobile Source Control Measures: Summary and Adjustments of Recent Results," *Transport Policy*, Vol. 11, No. 2: 155-169.

M. Wang, H. Lee, and J. Molburg, 2004, "Allocation of Energy Use and Emissions to Petroleum Refining Products: Implications for Life-Cycle Assessment of Petroleum Transportation Fuels," *International Journal of Life-Cycle Assessment*, 9 (1): 34-44.

Shapouri, H., J.A. Duffield, and M. Wang, 2003, "Corn Ethanol Energy Balance Revised," *Journal of American Society of Agricultural Engineers*, Vol.46 (4): 959-968.

M. Wang and Y. Wu, 2003, "The 21<sup>st</sup> Century Automotive Technology: Development and Status of Hybrid Electric Vehicles," book chapter of *On the Frontiers of Science* (in Chinese), edited by G. Liu, Vol. 2: 201-217, Tsinghua University Press, Beijing, China.

Streets, D.G., T.C. Bond, G.R. Carmichael, S.D. Fernandes, Q. Fu, D. He, Z. Klimont, S.M. Nelson, N.Y. Tsai, M.Q. Wang, J.H. Woo, and K.F. Yarber, 2003, "An Inventory of Gaseous and Primary Aerosol Emissions in Asia in the Year 2000," *Journal of Geophysics Research*, D21, Nov., pp.8809-8821.

M.Q. Wang, 2002, "Fuel Choices for Fuel-Cell Vehicles: Well-to-Wheels Energy and Emission Impacts," *Journal of Power Sources*, **112**: 307-312.

M. Wang, 2002, "Cost-Effectiveness of Mobile Source Non-CMAQ Control Measures: Methodological Issues and Summary of Recent Results," in *the Congestion Mitigation and Air Quality Improvement Program: Assessing 10 Years of Experience*, by the Committee for the Evaluation of the Congestion Mitigation and Air Quality Improvement Program, National Academy Press, Washington, D.C., June 2002.

Wang, M.Q., 2002, "Impacts of Greenhouse Gas Emissions of Using Alternative Transportation Fuels with Advanced Vehicle Technologies," in *Global Climate Change and Transportation: Coming to Terms*, pp.65-77, Eno Transportation Foundation, Washington, D.C.

Winebrake, J.J., M.Q. Wang, and D. He, 2001, "Toxic Emissions from Mobile Sources: a Total Fuel-Cycle Analysis for Conventional and Alternative-Fuel Vehicles," *Journal of the Air and Waste Management Association*, **51**: 1073-1086.

Streets, D.G., S. Gupta, S.T. Waldhoff, M.Q. Wang, T.C. Bond, and Y. Bo, 2001, "Black Carbon Emissions in China," *Atmospheric Environment*, **35**: 4281-4296.

D. He and M. Wang, 2000, "Contribution of Feedstock and Fuel Transportation to Total Fuel-Cycle Energy Use and Emissions," SAE paper 2000-01-2976.

M. Wang and D. He, 2000, "Full Fuel-Cycle Greenhouse Gas Emission Impacts of Transportation Fuels Produced from Natural Gas," SAE paper 2000-01-1505.

Singh, M., M. Wang, N. Hazard, and G. Lewis, 2000, "Quantifying the Fuel Use and Greenhouse Gas Reduction Potential of Electric and Hybrid Vehicles," SAE paper 2000-01-1581.

Wang, M.Q., 1999, "Fuel-Cycle Greenhouse Gas Emission Impacts of Alternative Transportation Fuels and Advanced Vehicle Technologies," *Transportation Research Record*, No.1664, pp.9-17.

Wang, M.Q., C.L. Saricks, and D. Santini, 1999, "Greenhouse Gas Emissions of Fuel Ethanol Produced from Corn and Cellulosic Biomass," *Environmental Manager*, Oct., pp.17-25.

Wang, M.Q., C.L. Saricks, and M. Wu, 1999, "Fuel Ethanol Produced from U.S. Midwest Corn: Help or Hindrance to the Vision of Kyoto?" *Journal of the Air and Waste Management Association*, **49**:756-772.

Mintz, M.M., M.Q. Wang, and A.D. Vyas, 1999, "Fuel-Cycle Energy and Emissions Impacts of Propulsion System/Fuel Alternatives for Tripled Fuel-Economy Vehicles," SAE paper 1999-01-1118.

Mintz, M., M. Wang, and A. Vyas, 1998, "Fuel-Cycle Energy and Emissions Impacts of Tripled Fuel Economy Vehicles," *Transportation Research Record*, No. 1641, pp.115-122.

Stork, K., M. Singh, M. Wang, and A. Vyas, 1998, "Assessment of Capital Requirements for Alternative Fuels Infrastructure under the PNGV Program," *Transportation Research Record*, No. 1641, pp.123-129.

Ross, M., R. Goodwin, R. Watkins, T. Wenzel, and M.Q. Wang, 1998, "Real World Emissions from Conventional Passenger Cars," *Journal of the Air and Waste Management Association*, **48**: 502-515.

Wang, Q., S. Hsu, and L. Duan, 1997, "Hydropower Projects and Dams in Europe," in *Modern China Studies*: No.3, Princeton, NJ, pp.23-35.

Hsu, S., Q. Wang, and L. Duan, 1997, "Social and Environmental Effects of the James Hydro-Electric Project in Canada," in *Modern China Studies*: No.3, Princeton, NJ, pp.46-68.

Wang, M.Q., 1997, "Greenhouse Gas Emission Impacts of Alternative-Fueled Vehicles: Near-Term vs. Long-Term Technologies Options," *World Resource Review*, **9**: 286-300.

Wang, M.Q., 1997, "Mobile Source Emission Control Cost-Effectiveness: Issues, Uncertainties, and Results," *Transportation Research-D*, **2**:43-56.

Vyas, A.D. and M.Q. Wang, 1996, "Potential Impacts of the Energy Policy Act on Electricity and Natural Gas Provide Fleets," *Transportation Research Record*, No.1520, pp.156-163.

Hu, P.S., M.Q. Wang, A.D. Vyas, M. Mintz, S.C. Davis, 1996, "Potential Coverage of Alternative Fuel Industries Under EPACT Section 501," *Transportation Research Record*, No.1520, pp.147-155.

Hu, P.S. and M.Q. Wang, 1996, "State Vehicle Fleets and Their Potential Acquisition of Alternative Fueled Vehicles under EPACT 507," *Transportation Research Record*, No.1520, pp.140-146.

Wang, M.Q. and D.J. Santini, 1995, "Monetary Values of Air Pollutant Emissions in Various U.S. Regions," *Transportation Research Record*, No.1475, pp.33-41.

Gaines, L. and M.Q. Wang, 1995, "Getting the Lead out of Electric Cars (a scientific letter to *Science*)," *Science*, **269**: 742-743.

Wang, M. Q., 1995, "Emission Reductions of Alternative-Fuel Vehicles: Implications for Vehicle and Fuel Price Subsidies," Chapter 7 of *Transportation and Energy: Strategies for a Sustainable Transportation System*, edited by D. Sperling and S. A. Shaheen, pp.117-138. American Council for an Energy-Efficient Economy, Washington, D.C.

Wang, M.Q. and W.W. Marr, 1994, "Greenhouse Gas Emission Impacts of Electric Vehicles under Varying Driving Cycles in Various Countries and U.S. Cities," *World Resources Review*, **6**: 316-335.

Wang, M.Q., 1994, "Cost Savings of Using a Marketable Permit System for Regulating Light-Duty Vehicle Emissions," *Transport Policy*, **1**: 221-232.

Wang, M.Q., D. Sperling, and J. Olmstead, 1994, "Emission Control Cost-Effectiveness of Alternative-Fuel Vehicles," *Fuel Reformulation*, **3** (No.3): 52-58.

Delucchi, M.A., D.L. Greene, and M.Q. Wang, 1994, "Motor-Vehicle Fuel Economy: the Forgotten Hydrocarbon Control Strategy?" *Transportation Research A*, **28A**: 223-244.

Wang, M.Q. and M.A. Delucchi, 1993, "Electric Vehicle Impacts and Economics," Chapter 4 of *Electric Vehicles: Technology, Performance, and Potential*, published by International Energy Agency, Paris, France, pp.139-166.

Wang, M.Q., 1993, "Life-Cycle Assessments: Additional Issues, Transportation Examples," *Environmental Science and Technology*, **27**: 2658-2661.

Wang, M.Q., D. Sperling, and C.L. Kling, 1993, "Emission Control Costs for Light-Duty Vehicles," *Journal of the Air and Waste Management Association*, **43**: 1455-1460.

Wang, M.Q., D. Sperling, and J. Olmstead, 1993, "Emission Control Cost-Effectiveness of Alternative-Fuel Vehicles," *SAE 1993 Transactions: Journal of Fuels and Lubricants*, **102**, Section 4, pp.789-820.

Wang, M.Q. and D.J. Santini, 1993, "Magnitude and Value of Electric Vehicle Emissions Reductions for Six Driving Cycles in Four U.S. Cities with Varying Air Quality Problems," *Transportation Research Record*, No.1416, pp.33-42.

Wang, M.Q. and M.A. Delucchi, 1992, "Impacts of Electric Vehicles on Primary Energy Consumption and Petroleum Displacement," *Energy*, **17**: 351-366.

Wang, M.Q., M.A. Delucchi, and D. Sperling, 1990, "Emission Impacts of Electric Vehicles," *Journal of the Air and Waste Management Association*, **40**: 1275-1285.

Delucchi, M.A., M.Q. Wang, and D. Sperling, 1989, "Electric Vehicles: Performance, Life-Cycle Costs, Emissions, and Recharging Requirements," *Transportation Research A*, **23**: 255-278.

Zheng, J., M.Q. Wang, and J. Fan, 1984, "Summary of Research Work on Water Resources in China," *Science and Technology of Meteorology*, No.10.

Zheng, J. and M.Q. Wang, 1983, "Analysis of Water Conditions in the Inner Mongolian Region," *Science of Agro-Meteorology*, Vol.3, No.1.

Zheng, J. and M.Q. Wang, 1982, "Analysis of Water Balance of Hainan Island," *China Journal of Tropical Crops*, Vol.3, No.2.

## PEER-REVIEWED PROCEEDINGS AND CONFERENCE PAPERS

Y. Wu, M. Wang, A. Vyas, D. Wade, T. Taiwo, 2004, "Well-to-Wheels Analysis of Energy Use and Greenhouse Gas Emissions of Hydrogen Produced with Nuclear Energy," in *Proceedings of ICAPP'04*, June, Pittsburgh, PA.

M. Wang, C. Saricks, and H. Lee, 2003, "Fuel-Cycle Energy and Emissions Impacts of Ethanol-Diesel Blends in Urban Buses and Farming Tractors," the 2003 Annual meeting of the Air and Waste Management Association, San Diego, CA, June 23-26.

Z. Hu, W. Han, C. Zhang, G. Pu, C. Wang, and M.Q. Wang, 2002, "Energy, Environment, Economic Life Cycle Assessment of Cassava-Ethanol Used as Automotive Fuel in Guangxi," the 14<sup>th</sup> International Alcohol Fuels Symposium, Phuket, Thailand, Nov. 11-14.

Y. Ren, X. Chen, R. Wu, W. Lu, W. Han, D. Schuetzle, J. Sullivan, R. McLeod, M.Q. Wang, H. Huo, and K. He, 2002, "Economic, Environmental and Energy Life Cycle Assessment of Natural Gas Based Automotive Fuels in Chongqing, China," the 14<sup>th</sup> International Alcohol Fuels Symposium, Phuket, Thailand, Nov. 11-14.

M.Q. Wang, 2002, "Well-to-Wheels Analysis of Fuel-Cell Vehicle/Fuel Systems," the Spring Conference of the American Institute of Chemical Engineers, New Orleans, LA, March 11.

D. He and M. Wang, 2001, "China's Motor Vehicle Growth in the Next Thirty Years and the Consequences on Motor Fuel Demand and CO<sub>2</sub> Emissions," the 2001 Annual Meeting of the Transportation Research Board, Washington, D.C., January 8-11.

P. Patterson, T. Bohn, N. Hazard, M. Singh, and M. Wang, 2000, "Quantifying the Fuel Use and Greenhouse Gas Reduction Potential of Electric and Hybrid Electric Vehicles," the 17<sup>th</sup> International Electric Vehicle Symposium and Exposition, Montreal, Canada, Oct. 15-18.

J. Winebrake, M. Wang, and D. He, 2000, "Toxic Emissions from Mobile Sources: a Total Fuel-Cycle Analysis for Conventional and Alternative Fuel Vehicles," the 93<sup>rd</sup> Annual Meeting of the Air and Waste Management Association, Salt Lake City, Utah, June 18-22.

Mintz, M.M., A. Vyas, M. Wang, F. Stodolsky, R. Cuenca, and L. Gaines, 2000, "From Here to the Efficiency: Time Lags between the Introduction of New Technology and the Achievement of Fuel Savings," the 79<sup>th</sup> Annual Meeting of Transportation Research Board, paper 001259, Washington, D.C., Jan. 9-13.

Wang, M., M. Mintz, M. Singh, K. Stork, A. Vyas, and L. Johnson, 1999, "Capital Requirements and Fuel-Cycle Energy and Emissions Impacts of Potential PNGV Fuels," the 32<sup>nd</sup> International Symposium on Automotive Technology and Automation, Vienna, Austria, June 14-18.

Wang, M.Q., C. Saricks, and D. Santini, 1998, "Fuel-Cycle Fossil Energy Use and Greenhouse Gas Emissions of Corn Ethanol," the 8<sup>th</sup> International Bioenergy Conference, Madison, Wisconsin, Oct. 5-8.

Wang, M.Q., C.L. Saricks, and M.M. Wu, 1998, "Greenhouse Gases in the Corn-to-Fuel Ethanol Pathway," the 91<sup>st</sup> Annual Meeting of the Air and Waste Management Association, San Diego, Calif., June 14-18.

Wang, M.Q., S. Plotkin, D.J. Santini, J. He, L. Gaines, and P. Patterson, 1997, "Total Energy-Cycle Energy and Emissions Impacts of Hybrid Electric Vehicles," the 14<sup>th</sup> International Electric Vehicle Symposium, Orlando, FL, Dec. 15-17.

Mintz, M., M. Wang, and A. Vyas, 1997, "Fuel-Cycle Energy and Emissions Impacts of Tripled Fuel Economy Vehicles," the 77<sup>th</sup> Annual Meeting of the Transportation Research Board, Washington, D.C., Jan.

Stork, K., M. Singh, M. Wang, and A. Vyas, 1997, "Assessment of Capital Requirements for Alternative Fuels Infrastructure under the PNGV Program," the 77<sup>th</sup> Annual Meeting of the Transportation Research Board, Washington, D.C., Jan.

Wang, M.Q., L. Gaines, and R. Cuenca, 1997, "Modeling the Vehicle Cycle Impacts of Hybrid Electric Vehicles," the 90<sup>th</sup> Annual Meeting of the Air and Waste Management Association, Toronto, Canada, June 8-13.

Saricks, C.L. and M.Q. Wang, 1996, "Clean Fuels: Does the New Direction Make Environmental Sense?" *Proceedings of the 89<sup>th</sup> Annual Meeting of the Air and Waste Management Association*, Nashville, TN, June 23-28.

Wang, M.Q. and L.R. Johnson, 1996, "Potential Transportation Infrastructure Changes Resulting from Commercialization of 80 MPG Vehicles," the 29<sup>th</sup> International Symposium on Automotive Technology and Automation, Florence, Italy, June 3-6.

Hu, P.S., S. Davis, M.Q. Wang, M. Mintz, T. Snyder, A. Vyas, and C. Hansen, 1994, "Preliminary Assessment of Fleets Covered by the Energy Policy Act", *Proceedings of the Annual Automotive Technology Development Contractors' Coordination Meeting*, pp.375-383, Dearborn, MI, Oct. 24 - 27.

Marr, W.W., M.Q. Wang, and D.J. Santini, 1994, "Effects of Battery Technologies, Driving Patterns, and Climate Comfort Control on the Performance of Electric Vehicles," *Proceedings of the 27<sup>th</sup> International Dedicated Conference on Electric, Hybrid and Alternative Fuel Vehicles and Supercars (Advanced Ultralight Hybrids)*, pp.461-467, Aachen, Germany, Oct. 31 - Nov. 4.

Wang, M.Q., C.L. Kling, and D. Sperling, 1992, "Marketable Credits for Light-Duty Vehicle Emission Control In California," *Proceedings of the 85<sup>th</sup> Annual Meeting of the Air and Waste Management Association*, Pittsburgh, PA, June.

Wang, M.Q., D.L. Greene, and M.A. Delucchi, 1991, "Effects of Fuel Economy Improvements on Vehicle HC Emissions," *Proceedings of the 84<sup>th</sup> Annual Meeting of the Air and Waste Management Association*, Pittsburgh, PA, June.

## **EXTERNALLY REVIEWED FORMAL REPORTS**

M. Wang, 2002, *Assessment of Well-to-Wheels Energy Use and Greenhouse Gas Emissions of Fischer-Tropsch Diesel*, Center for Transportation Research, Argonne National Laboratory, prepared for Office of FreedomCar and Vehicle Technologies, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, Washington, D.C., Oct. 4.

Shapouri, H., J.A. Duffield, and M. Wang, 2002, *The Energy Balance of Corn Ethanol: an Update*, U.S. Department of Agriculture, Office of the Chief Economist, Agricultural Economic Report No. 814, Washington, D.C., July.

Plotkin, S., D. Santini, A. Vyas, J. Anderson, M. Wang, J. He, and D. Bharathan, 2001, *Hybrid Electric Vehicle Technology Assessment: Methodology, Analytical Issues, and Interim Results*, Center for Transportation Research, Argonne National Laboratory, ANL/ESD/02-2, Argonne, IL, Oct.

General Motors Corporation, Argonne National Laboratory, BP, ExxonMobil, and Shell, 2001, *Well-to-Wheel Energy Use and Greenhouse Gas Emissions of Advanced Fuel/Vehicle Systems: A North American Analysis, Volume 1, Executive Summary Report*, ANL/ES/RP-104528; June.

General Motors Corporation, Argonne National Laboratory, BP, ExxonMobil, and Shell, 2001, *Well-to-Wheel Energy Use and Greenhouse Gas Emissions of Advanced Fuel/Vehicle Systems: A North American Analysis, Volume 2, Main Report*, ANL/ES/RP-104528; June.

General Motors Corporation, Argonne National Laboratory, BP, ExxonMobil, and Shell, 2001, *Well-to-Wheel Energy Use and Greenhouse Gas Emissions of Advanced Fuel/Vehicle Systems: A North American Analysis, Volume 3, Well-to-Tank Energy Use and Greenhouse Gas Emissions of Transportation Fuels*, ANL/ES/RP-104528; June.

J. Winebrake, D. He, and M. Wang, 2000, *Fuel-Cycle Emissions for Conventional and Alternative Fuel Vehicles: An Assessment of Air Toxics*, ANL/ESD-44, Center for Transportation Research, Argonne National Laboratory, Argonne, IL, Aug.

Wang, M. and H. Huang, 1999, *A Full Fuel-Cycle Analysis of Energy and Emissions Impacts of Transportation Fuels Produced from Natural Gas*, ANL/ESD-40, Center for Transportation Research, Argonne National Laboratory, Argonne, IL, Dec.

Wang, M., 1999, *GREET 1.5 – Transportation Fuel-Cycle Model, Volume 1: Methodology, Development, Use, and Results*, ANL/ESD-39, Vol.1, Center for Transportation Research, Argonne National Laboratory, Argonne, IL, Aug.

Wang, M., 1999, *GREET 1.5 – Transportation Fuel-Cycle Model, Volume 2: Appendices of Data and Results*, ANL/ESD-39, Vol.2, Center for Transportation Research, Argonne National Laboratory, Argonne, IL, Aug.

Wang, M., C. Saricks, and D. Santini, 1999, *Effects of Fuel Ethanol Use on Fuel-Cycle Energy and Greenhouse Gas Emissions*, ANL/ESD-38, Center for Transportation Research, Argonne National Laboratory, Argonne, IL, Jan.

Singh, M., L. Gaines, D. Santini, M. Wang, B. Marr, R. Cuenca and J. Formento, 1998, *Total Energy Cycle Assessment of Electric and Conventional Vehicles: An Energy and Environmental Analysis*, 4 Volumes, ANL, PNNL, NREL for USDOE/EERE, Jan.

Wang, M.Q., M.M. Mintz, M. Singh, K. Stork, A. Vyas, and L. Johnson, 1998, *Assessment of PNGV Fuels Infrastructure, Phase 2 Report: Additional Capital Needs and Fuel-Cycle Energy and Emissions Impacts*. ANL/ESD-37, Center for Transportation Research, Argonne National Laboratory, Argonne, IL, Aug.

Wang, M.Q., C. Saricks, and M. Wu, 1997, *Fuel-Cycle Fossil Energy Use and Greenhouse Gas Emissions of Fuel Ethanol Produced from U.S. Midwest Corn*, prepared for Illinois Department of Commerce and Community Affairs, Center for Transportation Research, Argonne National Laboratory, Argonne, IL, Dec.

Oak Ridge National Laboratory and Resources for the Future, 1996, *Estimating Externalities of Oil Fuel Cycles*, report No. 5 on the External Costs and Benefits of Fuel Cycles: a Study by the U.S. Department of Energy and the Commission of the European Communities, Aug.

Wang, M.Q., 1996, *Development and Use of the GREET Model to Estimate Fuel-Cycle Energy Use and Emissions of Various Transportation Technologies and Fuels*, Center for Transportation Research, Argonne National Laboratory, ANL/ESD-31, March.

Ross, M., R. Goodwin, R. Watkins, M.Q. Wang, and T. Wenzel, 1995, *Real-World Emissions from Model Year 1993, 2000, and 2010 Passenger Cars*, American Council for an Energy-Efficient Economy, Washington, D.C., Nov.

Bailey, K., G. Boyd, T. Elliott, R. Fisher, J. Formento, K. Guziel, E. Kohout, A. Loeb, J. Molbulg, E. Portante, C. Saricks, D. South, D. Streets, P. Thimmapuram, and M. Wang, 1995, *Development of Emission Control and New Technology Options for the Grand Canyon Visibility Transport Region, Volume I: Technology Costs, Performance, and Applicability*, prepared for the Grand Canyon Visibility Transport Commission, Argonne National Laboratory, Oct.

Wang, M.Q., D.J. Santini, and S.A. Warinner, 1994, *Methods of Evaluating Air Pollution and Estimated Monetary Values of Air Pollutants*, Center for Transportation Research, Argonne National Laboratory, ANL/ESD-26, Dec.

Wang, M.Q., 1992, *The Use of a Marketable Permit System for Light-Duty Vehicle Emission Control*, Ph.D. dissertation, Graduate Division, University of California at Davis, CA, March.

Kling, C.L., M.Q. Wang, and D. Sperling, 1992, *Economic Incentives to Introduce Electric and Natural Gas Vehicles and Reduce Mobile Source Emissions*, prepared for the California Institute for Energy Efficiency, Institute of Transportation Studies, University of California at Davis, CA, June.

Delucchi, M.A., M.Q. Wang, and D.L. Greene, 1992, *Motor Vehicle Fuel Economy, the Forgotten HC Control Strategy?* ORNL-6715, Oak Ridge National Laboratory, Oak Ridge, TN, June.

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## **NON-PEER-REVIEWED PUBLICATIONS AND REPORTS**

M. Wang, 2004, "the Role of Ethanol Can Play in Our Energy Policy," letter to *Chicago Tribune*, Feb. 23.

M. Wang, 2003, "Hydrogen a Transportation Fuel," letter published in *the Oil and Gas Journal*, Aug. 25 Issue, pp.11-12.

M. Wang, C. Saricks, and H. Lee, 2003, *Fuel-Cycle Energy and Emission Impacts of Ethanol-Diesel Blends in Urban Buses and Farming Tractors*, prepared for Illinois Department of Commerce and Economic Opportunities, by Center for Transportation Research, Argonne National Laboratory, Argonne, IL, July.

M. Wang, 2002, "Well-to-Wheels Analysis of Energy and Emission Impacts of Fuel-Cell Vehicle Fuels," in *2002 Annual Progress Report: Fuels for Advanced CIDI Engines and Fuel Cells*, Office of Hydrogen, Fuel Cell, and Infrastructure Technologies, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, Washington, D.C., Dec.

M. Wang, 2002, *Well-to-Wheels Energy and Greenhouse Gas Emissions Impacts of Liquefied Petroleum Gas Vehicles*, prepared for the World LP Gas Association, Paris, France, Nov.

M. Wang, 2002, *Fuel-Cycle Energy and Greenhouse Gas Emissions Impacts of Space Heaters and Water Heaters Powered by Different Fuels*, prepared for the World LP Gas Association, Paris, France, Sept.

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